

Simultaneous optimization of mode dispersion, propagation loss, and guiding bandwidth in photonic crystal waveguides

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We demonstrate both theoretically and experimentally dispersion engineering in photonic crystal waveguides (PCWs) enabled by controlling the geometrical properties of the region next to the core of these waveguides. It is known that modifying the radius of the air holes next to the guiding region can be used to modify the frequency extent of the mode within the photonic bandgap (PBG) and to obtain single-mode guiding [1]. On the other hand, perturbing the periodicity of the two rows of the PCW next to the guiding region can be used to obtain linear dispersion and low guiding loss over a large bandwidth within the PBG [2].

In this paper, we demonstrate a systematic technique for dispersion engineering in PCWs by simultaneous modification of the hole size and periodicity next to the guiding region. We present theoretical and experimental results and show that this approach can be used to optimize PCWs for desired application. The results specifically show that it is possible to design practical single-mode PCWs with low loss over a large bandwidth. We also address the possibility of further controlling the dispersion properties of PCWs by modifying the index of refraction of the material inside the holes next to the guiding region.

[1] A. Adibi et al., *Electronics Letters*, **16**, 1376 (2000).

[2] A. Jafarpour et al., *Physical Review B*, **68**, 233102 (2003).